respectively. Beam deflectors **112** and **122** may be any type of optical element capable of repositioning the projected images **160** and **170** respectively, in a controllable fashion. One type of optical element that may be particularly useful for beam deflectors **112** and **122** is a relatively thick piece of transparent glass with flat, parallel faces. Because of the flat parallel faces, the glass "plate" would have zero optical power. It is well known that such glass plates will deflect an optical beam when the plate is tilted with respect to the beam direction. The amount of deflection is determined by the thickness of the plate (t), angle of incidence (θ) and index of refraction of the plate (n), according to the formula:

$$d = t\sin\left[\theta_i - \sin^{-1}\left(\frac{\sin\theta_i}{n}\right)\right] \Big/ \cos\left[\sin^{-1}\left(\frac{\sin\theta_i}{n}\right)\right]$$

This equation describes the deflection in one direction only. It can be extended to two dimensions for glass plates or beam deflectors which are capable of two dimensional motion. In a preferred embodiment, beam deflectors **112** and **122** each include a two axis gimbal which are capable of horizontally deflecting the images **160** and **170**, respectively by rotation around vertical axes **114** and **124** respectively. Vertical deflections of the images **160** and **170** can be achieved by rotating the beam deflectors **112** and **122**, respectively about horizontal axes **116** and **126**. In a preferred embodiment, the beam deflectors **112** and **122** are capable of automatic self-adjusting for any misalignment that may occur during operation of the system **100**. A preferred system may include some means for electronically controlling the beam deflectors **112** and **122**, which is represented in the FIGURE as a control block **130** for controlling gimbal drives **140**, which may be a well-known electromechanical device coupled to the beam deflectors **112** and **122** by any appropriate connection means. The control block **130**, and the gimbal drives **140** and the connections with each other and the beam deflectors are well known in the art. A camera **180** is shown coupled to control block **130**. Camera **180** is also well known in the art and is used to monitor the alignment of images **160** and **170**. The camera **180** may also detect infrared registration information or fiducial marks projected along with the desired image to aid in image alignment. Control block **130** may receive a signal from the camera **180** and process it to determine the existence, extent and direction of any misalignment of images **160** and **170**. The circuitry or software for such detection is well known in the art, and it may be located in the camera **180** itself or in a central control block **130** or in any other configuration, such as in the projectors **110** and **120** or distributed among them and other control devices.

In an alternate embodiment, one of the beam deflectors may be omitted or may be a stationary glass plate without any gimbal and gimbal drive and which is not coupled to the camera **180**. The alignment could be completely achieved by manipulation of the other beam deflector only. This could achieve a cost and weight savings. This stationary glass plate would be optically identical to the gimballed beam deflector and, therefore, would maintain equal optical path lengths from projectors **110** and **120** to images **160** and **170**. The maintenance of equal optical path lengths should provide for less aberration correction than otherwise might occur with unequal optical path lengths. In an alternate embodiment, the beam deflectors **112** and **122** may be incorporated into their respective projectors **110** and **120** and may be located either between the projection optics of the projectors, not shown, and the images **160** and **170** (as shown in the FIGURE) or between the projection optics and an image source, not shown, in the projector. The exact implementation details may vary, depending upon the particular needs of the system and the customer and the component parts chosen by the designer and or customer.

In operation, the apparatus and method of the present invention could function as follows:

An image to be projected upon a display surface is determined, the image is projected by at least two projectors, each projecting a separate portion of the tiled image, a camera or other detector is used to monitor the alignment of the separate portions to assure that no gaps or overlapping occurs. This monitoring can be done with a servo loop feedback type arrangement where the images are moved in a predetermined manner and the motion is monitored and controlled to minimize gaps and overlapping of the separate portions. The motion of the images is achieved by manipulating, in one or more dimensions, a rotation of one or more of the beam deflectors **112** and **122**. When a misalignment occurs, the situation will be detected by the above-described monitoring function and will be corrected as part of the monitoring function. The projectors **110** and **120** and control block **130** may be coupled to flight control computers or inertial reference systems on-board the aircraft (not shown). The image to be displayed, the algorithms that control movement of gimbals, and how the image is displayed may be changed as a function of the operation of the aircraft. For example, if the aircraft is involved in landing maneuvers or is being subjected to high forces, then the image to be displayed may be altered or the system or method for monitoring the alignment of the tiled images may be adjusted. Other operational schemes can be utilized as well.

It is thought that the method and apparatus of the present invention will be understood from the foregoing description and that it will be apparent that various changes may be made in the form, construct steps and arrangement of the parts and steps thereof without departing from the spirit and scope of the invention or sacrificing all of their material advantages. The form herein described is merely a preferred exemplary embodiment thereof.

I claim:

1. An apparatus for projecting an image in an aircraft cockpit comprising:

a first projector for projecting a first image, in a first projection beam;

a second projector for projecting a second image, in a second projection beam;

a viewing screen for viewing the first image and the second image;

a first beam deflector disposed between said first projector and said first image;

a second beam deflector disposed between said second projector and said second image;

a beam deflector drive for continuously manipulating an orientation of at least one of said first beam deflector and said second beam deflector in response to a beam deflector drive signal; and

a sensor for sensing an alignment characteristic of said first image and said second image and generating the beam deflector drive signal in response to said alignment characteristic.

2. An apparatus of claim **1** wherein said first beam deflector has a two-dimensional gimbal coupled to an optical element having a predetermined optical characteristic.

3. An apparatus of claim **1** wherein said first beam deflector is a stationary flat glass plate.